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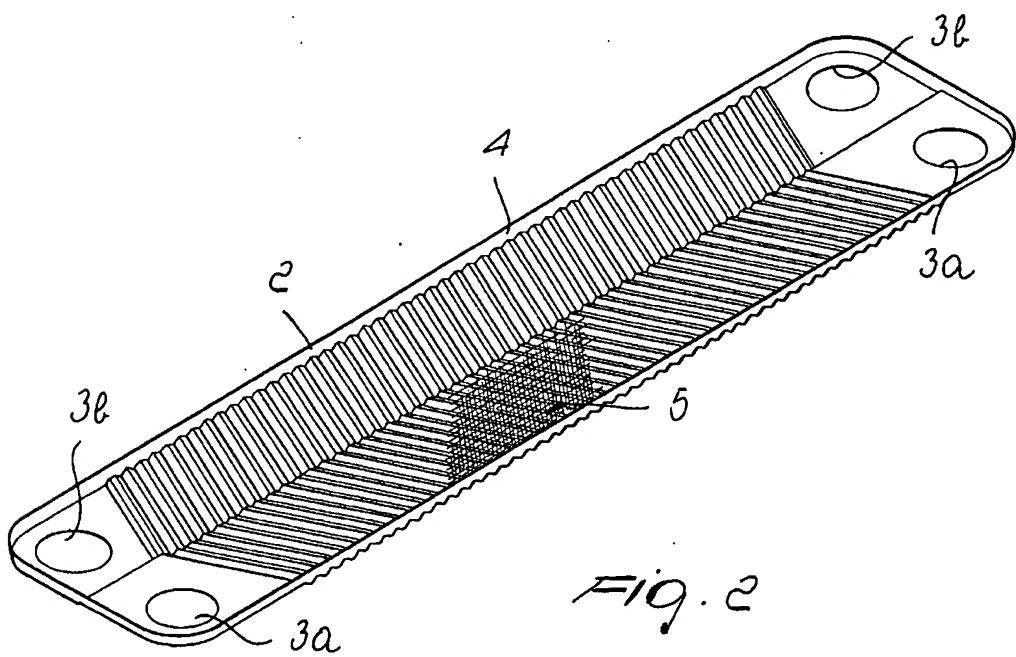
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### (54) Plate heat exchanger

(57) A plate heat exchanger (1), comprising a plurality of mutually facing plates (2) that are hermetically coupled at at least one substantially peripheral portion (4) and form at least two separate circuits for at least

two fluids, each one of said plurality of plates (2) having access ports that provide input ducts (3a) and output ducts (3b) for said at least two fluids, at least one portion (5) of at least one face of at least one of said plurality of plates (2) being uneven.



**Description**

**[0001]** The present invention relates to a plate heat exchanger, particularly but not exclusively useful for condensing and evaporating refrigerating fluids.

**[0002]** As is known, plate heat exchangers are devices used to transfer heat energy from one fluid to another and are constituted by a plurality of mutually facing metal plates shaped so as to form, in the spaces between two adjacent plates, a corresponding plurality of passage circuits for the fluids.

**[0003]** The plates are usually rectangular, are commonly obtained by pressing and have appropriate corrugations, substantially in the central region, and generally have four openings at their corners. The corrugations are designed to stiffen the plates and to improve heat exchange, while the openings are designed to provide the ducts for the distribution and recovery of the fluids.

**[0004]** The plates are sealed at their perimeter and at their input and output ducts by means of gaskets or by welding and/or braze welding, so as to prevent the escape of the fluids from the respective ducts and from the circuits formed between the facing plates.

**[0005]** Operation of plate heat exchangers consists in producing the alternating flow, in the passage circuits, of a refrigerating fluid, which evaporates or condenses, and of a heat transfer fluid, which becomes cooler or warmer.

**[0006]** The aim of the present invention is to provide a plate heat exchanger with improved performance with respect to exchangers currently in use while maintaining a low production cost and achieving high reliability and durability.

**[0007]** This aim and other objects that will become better apparent hereinafter are achieved by a plate heat exchanger, comprising a plurality of mutually facing plates that are hermetically coupled at at least one substantially peripheral portion and form at least two separate circuits for at least two fluids, each one of said plurality of plates having access ports that provide input ducts and output ducts for said at least two fluids, characterized in that at least one portion of at least one face of at least one of said plurality of plates is uneven.

**[0008]** Further aspects and advantages of the present invention will become better apparent from the following detailed description of some currently preferred examples of embodiments, given merely by way of non-limitative example with reference to the accompanying drawings, wherein:

Figure 1 is a partially sectional perspective view of the plate heat exchanger according to the invention; Figure 2 is a perspective view of a plate of the plate exchanger according to the invention;

Figure 3 is an enlarged-scale plan view of a portion of a plate of the heat exchanger according to the invention, with a surface that is uneven due to the

presence of microengravings.

**[0009]** In the examples of embodiment that follow, individual characteristics, given in relation to specific examples, may actually be interchanged with other different characteristics that exist in other examples of embodiment.

**[0010]** With reference to the figures, the plate heat exchanger according to the invention, generally designated by the reference numeral 1, comprises a plurality of mutually facing plates 2 and generally at least two ducts, an input duct 3a and an output duct 3b, for a respective fluid.

**[0011]** The plates 2 are usually coupled hermetically to each other either by interposing gaskets, not shown in the figures, at a substantially peripheral portion 4 and at the ducts 3a and 3b, or by welding or braze welding.

**[0012]** Advantageously, each plate 2 has, as shown more clearly in Figure 2, a main corrugation, generally arranged in a herringbone pattern, which is adapted to increase and facilitate the exchange of heat among passage circuits formed between two adjacent plates 2.

**[0013]** According to the invention, at least one of the plates 2 has at least one face that comprises at least one uneven portion 5.

**[0014]** Advantageously, said portion 5 is uneven thanks to the presence of microengravings and/or microgrooves and/or microindentations.

**[0015]** In one example of embodiment, each plate 2 has at least one completely uneven face.

**[0016]** Conveniently, the adjacent plates 2 are assembled so that their completely or partially uneven faces form at least the ducts for the refrigerating fluid.

**[0017]** Moreover, nothing prevents the use of plates 2 in which both faces are uneven.

**[0018]** According to the invention, the uneven portion 5 of the plates 2 can be obtained in various manners. These manners can include, merely by way of non-limitative example, mechanical processes such as for example sanding, brushing, satin finishing, sandpapering, coining, drawing, rolling, mechanical incision and pressing.

**[0019]** Furthermore, the uneven portion 5 can also be obtained by way of processes of the chemical, electrochemical, electronic or chemical-physical type: these processes can include for example controlled corrosion, metallization, melting, plating, explosion, electronic or laser alteration, photoengraving, et cetera.

**[0020]** Operation of a plate heat exchanger according to the invention is clearly evident from what has been described above.

**[0021]** In practice it has been found that a plate heat exchanger according to the invention fully achieves the intended aim and objects.

**[0022]** In particular, the fact is stressed that thanks to the presence of the uneven portion or of the uneven face or faces, a considerable improvement in the performance of the plate heat exchanger according to the in-

vention in the condensation and evaporation of refrigerating fluids has been achieved.

[0023] The presence of microengravings and/or microgrooves and/or microindentations on the exchange surface in fact increases the area of the exchange surface, increases the turbulence of the fluid in contact with the exchange surface, facilitates the drainage of the liquid along the exchange surface in condensation processes and bubble nucleation the evaporation processes.

[0024] All the characteristics of the invention indicated above as advantageous, convenient or the like may also be omitted or be replaced by equivalents.

[0025] The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims.

[0026] In practice, the materials used, so long as they are compatible with the contingent use, as well as the shapes and dimensions, may be any according to requirements.

[0027] All the details may further be replaced with other technically equivalent elements.

[0028] The disclosures in Italian Utility Model Application No. VR2002U000051 from which this application claims priority are incorporated herein by reference.

[0029] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

#### Claims

1. A plate heat exchanger, comprising a plurality of mutually facing plates that are hermetically coupled at at least one substantially peripheral portion and form at least two separate circuits for at least two fluids, each one of said plurality of plates having access ports that provide input ducts and output ducts for said at least two fluids, **characterized in that** at least one portion of at least one face of at least one of said plurality of plates is uneven.

of the preceding claims, **characterized in that** said at least one uneven portion is obtained by way of a mechanical process.

5. The plate heat exchanger according to one or more of the preceding claims, **characterized in that** said at least one uneven portion is obtained by way of a chemical or electrochemical or chemical-physical process.

10. 6. The plate heat exchanger according to one or more of the preceding claims, **characterized in that** said at least one uneven portion is obtained by way of a process of the electronic type.

15. 7. The plate heat exchanger according to one or more of the preceding claims, **characterized in that** said plurality of plates are joined to each other by welding and/or braze welding.

20. 8. The heat exchanger according to one or more of the preceding claims, **characterized in that** said plates are mutually joined by interposing sealing gaskets.

25. 9. The heat exchanger according to one or more of the preceding claims, **characterized in that** said mechanical process is sanding or brushing or satin finishing or sandpapering or coining or drawing or pressing.

30. 10. The heat exchanger according to one or more of the preceding claims, **characterized in that** said at least one uneven portion is obtained by way of a process of the chemical or electrochemical type that comprises controlled corrosion.

35. 11. The heat exchanger according to one or more of the preceding claims, **characterized in that** said at least one uneven portion is obtained by way of a process of the electronic type that comprises controlled alteration or laser alteration or photoengraving.

2. The plate heat exchanger according to claim 1, **characterized in that** said at least one face provided with at least one uneven portion forms, together with the respective adjacent and facing plate, one of said at least two circuits.

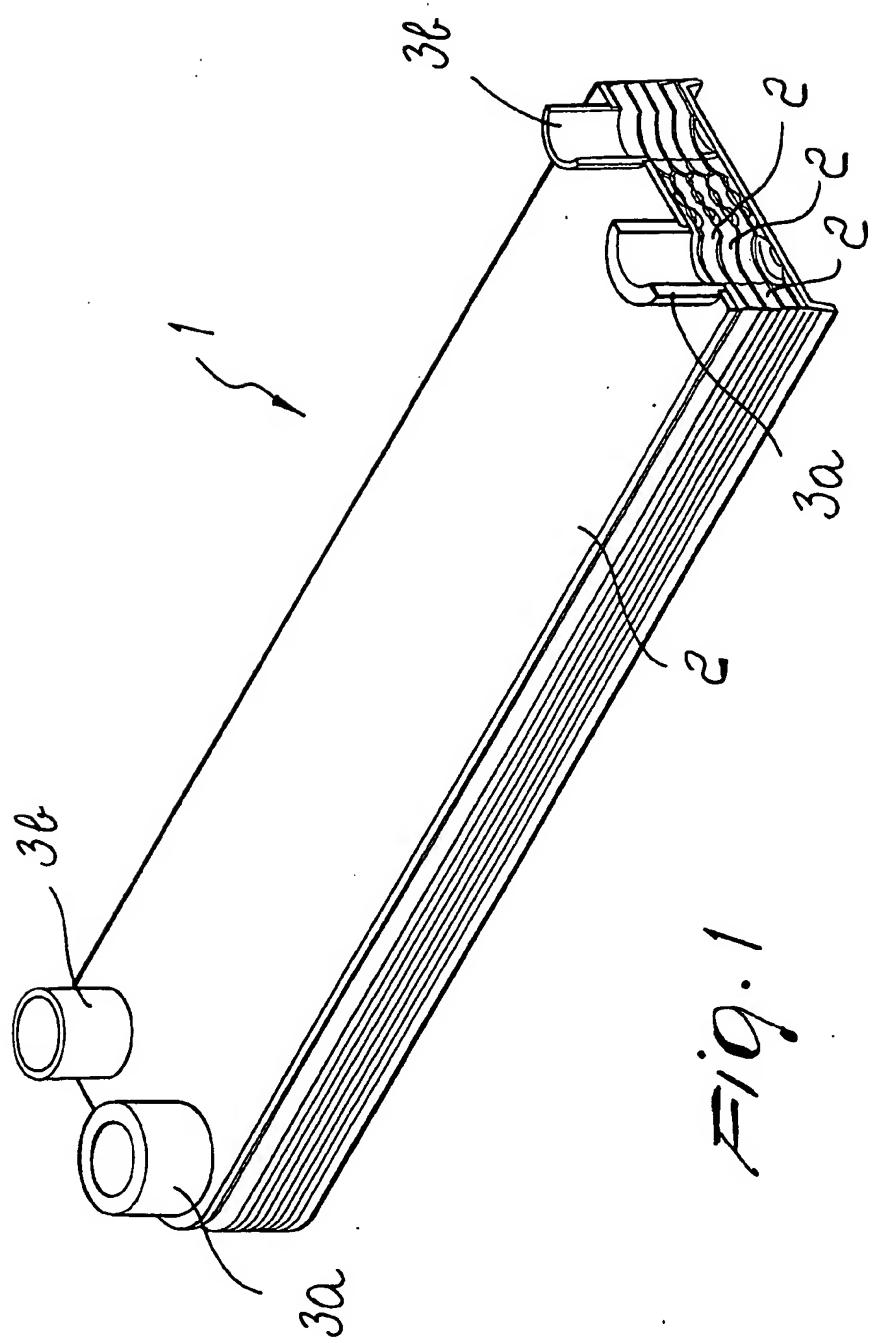
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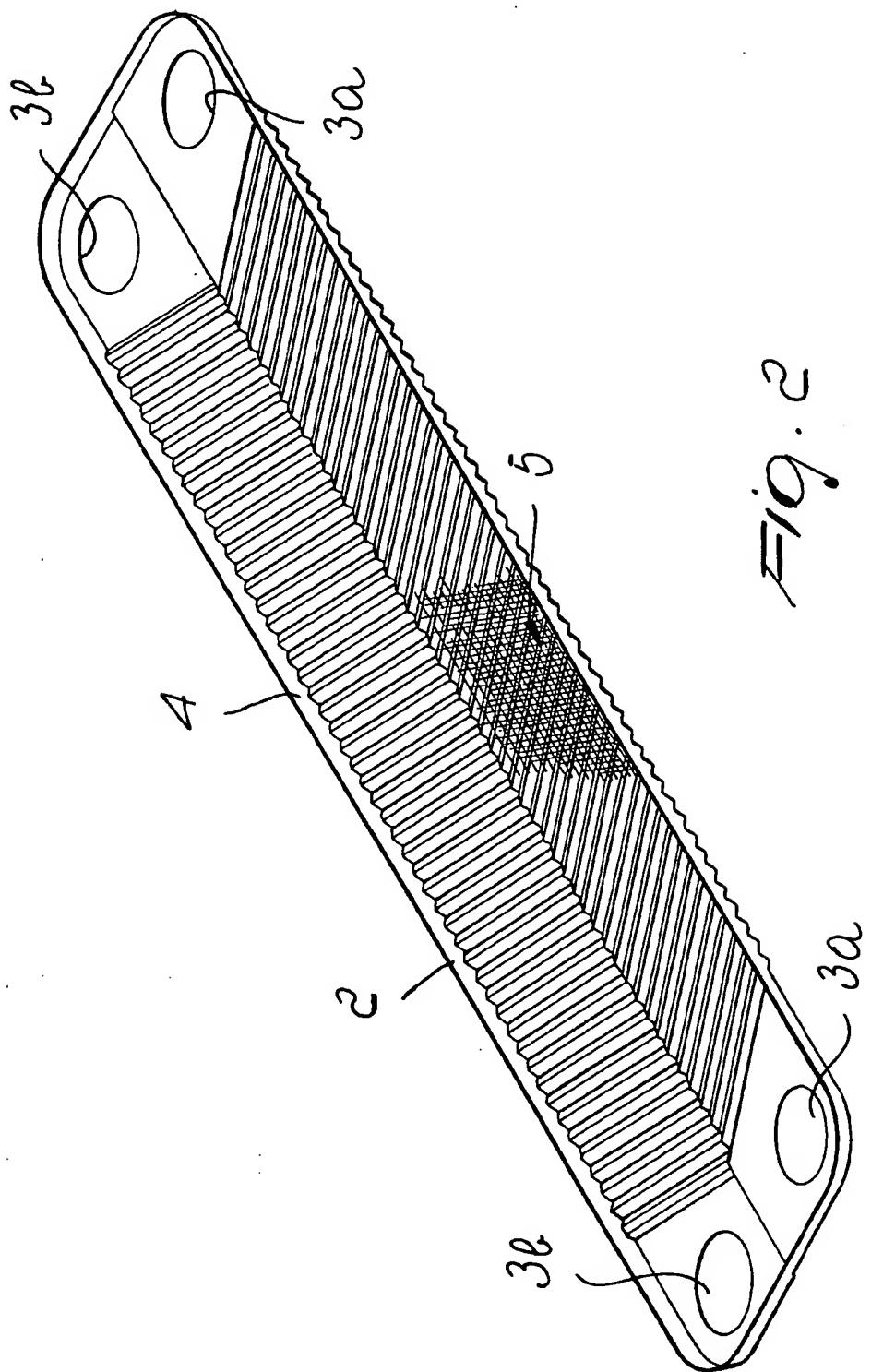
3. The plate heat exchanger according to one or more of the preceding claims, **characterized in that** at least one face of each one of said plurality of plates is uneven.

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4. The plate heat exchanger according to one or more

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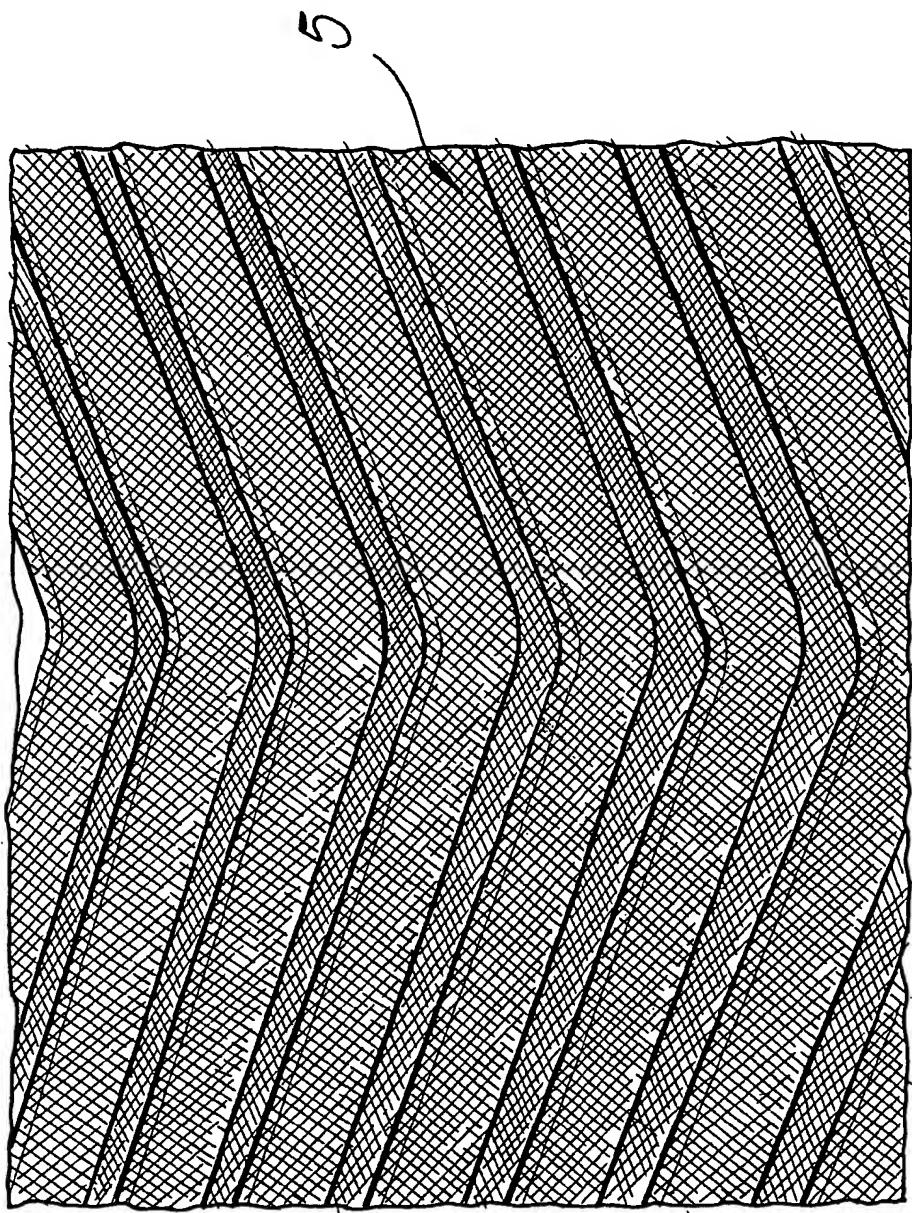


Fig. 3